

## Map Unit Properties Table

Age	Unit Name (Symbol)	Features and Descriptions	Erosion Potential	Potential Hazards	Water Resources and Water Quality (WQ)	Potential for Groundwater Contamination	Paleontologic Resources	Mineral Resources	Potential Cultural Resources	Global Significance
Quaternary	Alluvium (Qa)	Unconsolidated sand, mud, gravel; river bank deposits; includes older debris-flow deposits west of Little Creek Sinks on the Upper Kolob Plateau	High	Low	Unconsolidated aquifer; moderate to very large yields; fresh to saline WQ		Bison bones ( <i>Bison antiquus</i> ) (1)	Sand and gravel	Historic and prehistoric settlement, agriculture, pigment	None
	Lake Bed Deposits (Ql)	Lacustrine deposits associated with at least 14 lakes are known in the park. Deposits include sand, clay, limestone, sand- to pebble- size cinders (Coalpits Lake) and peat (Hop Valley Lake)	High	Low	Limited; low aquifer yields; fresh water		Bird and camel track & pollen (2)		Settlement and agriculture	None
	Eolian Sand (Qe)	Unconsolidated sand	Very High	Variable landslide potential; low hazard potential; expandable or collapsing soil	Local aquifer; large to very large yields; fresh water		None documented (o)			None
	Basalt Flows (Qb)	Medium to dark gray, weathering dark grayish brown to black, basalt (basalt, trachybasalt, basaltic trachyandesite, and basaltic andesite); phenocryst poor; scattered white plagioclase, common tiny dark-greenish-brown olivine and black pyroxene phenocrysts; flows typically 3- 12 m (10- 40 ft) thick, but may reach several hundred feet thick where flows fill canyons	Low	Variable landslide potential; Cliff former; potential rockfall	Local aquifer; large to very large yields; fresh water		None documented (o)	Cinders	Tool material, rock art	None
	Landslides and Talus (Qms)	Unconsolidated clastics; variable lithologies	Variable	Very high potential for reactivation of landslide if undercut	Low aquifer potential; variable yields; fresh water	Low	Trace fossils on blocks (1)			None
Tertiary	Old Boulder Gravel Deposits (Tu)	Undifferentiated igneous and sedimentary deposits; widespread to the north, but removed by erosion from ZION	Not in ZION	Not in ZION	Not in ZION	Not in ZION	Not in ZION (1)	Not in ZION	Not in ZION	None
Regional Unconformity										
Upper Cretaceous	Tropic Shale (Kt)	Gray marine shale and sandstone with coal.	High	Very high potential for landslides; expandable or collapsing soils	Low aquifer potential; saline WQ	Low	Ammonites (marine); plesiosaur (2)			Maximum development of Cretaceous Western Interior Sea
	Dakota Sandstone (Kd)	Pebble and cobble conglomerate and tan sandstone; may represent previously unrecognized Cedar Mountain Formation; about 30 m (100 ft) thick	Low	Very high landslide potential; low rockfall potential; expandable or collapsing soils	Limited aquifer potential; small to moderate yield; fresh to saline WQ	Low	Bones and plants, freshwater bivalves, (2)	Coal, Uranium	Tool material	None
Regional Unconformity										
Middle Jurassic	Carmel Fm. Winsor member (Jcw)	Sandstone and siltstone; widely exposed on the Upper Kolob Plateau north and east of the park but is not exposed within the main part of ZION; 55- 85 m (180- 280 ft) thick	High	Very high landslide potential; low rockfall potential	Limited aquifer potential; small to moderate yield; poor WQ	Low	None documented (o)		Alcove beneath Kd cliffs	None
	Carmel Fm. Paria River mbr (Jcp)	Lower three-quarters is ledge and cliff-forming alabaster gypsum with a few thin mudstone or sandstone interbeds; upper part is ledge-forming, thin-bedded, platy- or chippy-weathering micritic and argillaceous limestone; only preserved in the northeast part of the park but widely exposed to the north and east on the Upper Kolob Plateau; 15- 24 m (50- 80 ft) thick	High	Variable landslide potential; low rockfall potential; expandable or collapsing soils	Limited aquifer potential; small to moderate yield; poor WQ	Gypsum	Small, poorly preserved pelecypods, ostracodes, and <i>Pentacrinus</i> sp. (star-shaped) crinoid columnals (2)	Gypsum		None
	Carmel Fm. Crystal Creek mbr (Jcx)	Sandstone and siltstone; only preserved in the northeast part ZION near Lava Point and north of Orderville Canyon; 46- 56 m (150- 185 ft) thick	High	Low landslide potential; low rockfall potential	Limited aquifer potential; small to moderate yield; poor WQ	Moderate	None documented (o)			None

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Middle Jurassic	Carmel Fm. Coop Creek mbr (Jcc)	Gray resistant, fossiliferous, limestone; plateau forming veneered by thin layer of unconsolidated reddish- brown loess and residual Crystal Creek sediments; upper unit 30- 33 m (100- 110 ft) thick, lower unit is 46- 53 m (150- 170 ft) thick	High	Low landslide potential; moderate rockfall potential	Limited aquifer potential; small to moderate yield; poor WQ	Moderate	Marine pelecypods, gastropods, <i>Pentacrinus</i> sp. crinoid columnals (2)	Limestone		None
Regional Unconformity										
Middle Jurassic	Temple Cap Sandstone White Throne mbr (Jtw)	Sandstone from wind- blown sand dunes; thins westward and pinches out near the Hurricane fault; top was beveled flat by encroaching seas; 0- 58 m (0- 190 ft) thick	Moderate	Low landslide potential; high rockfall potential	Limited aquifer potential; moderate yield; fresh WQ	Low	None documented (o)			None
	Temple Cap Sandstone Sinawava mbr (Jts)	Red mudstone and siltstone; 12- 18 m (40- 60 ft) thick	High	Low landslide potential; moderate rockfall potential	Limited aquifer potential; small to moderate yield; fresh WQ	Moderate	None documented (o)			None
Regional Unconformity										
Lower Jurassic	Navajo Sandstone (Jn)	Moderately well- cemented, well- rounded, frosted, fine- to medium- grained quartz sandstone; weathers to bold, rounded cliffs; large- scale cross- beds; locally exceeds 610 m (2,000 ft); three informal subunits based on color, in ascending order, brown, pink, and white.  White subunit: forms highest cliffs in ZION (Great White Throne); highly jointed massive vertical cliffs; top is locally stained red by runoff from the mudstone and siltstone of the overlying Sinawava mbr or the Temple Cap Fm.; 0- 244 m (0- 800 ft) thick.  Pink subunit: uniformly stained by iron oxides (hematite); porous and friable; high- angle eolian cross- beds; sheets, concretions, and nodules of ironstone (1- 20 percent iron oxide) litter some outcrops; 183- 305 m (600- 1,000 ft) thick  Brown subunit: vertical cliff- former; cemented by iron oxide; hanging valleys form at top; 122- 183 m (400- 600 ft) thick	High erosion potential at fractures	High landslide potential if cliffs are undercut; very high rockfall potential from cliffs	Primary aquifer; Moderate to very large yields; fresh WQ	Low potential for contamination	Poor preservation; tridactyl dinosaur tracks; fossil wood (1)	Copper, oil, glass sand	Alcoves in cliff, rock art, pigment, tool material	Potential for type locality; sand dunes may have been part of the largest erg recorded on Earth
	Kayenta Fm. (Tk)	Red and mauve siltstones, shale, and sandstones; slope- former; commonly covered by talus; Lamb Point Tongue (0- 37 m, 0- 120 ft thick) of Navajo Sandstone forms a ledge about one- third of the way down from the base of the Navajo in Zion and Parunuweap Canyons; lower two- thirds is the main body of the Kayenta and is 88- 110 m (290- 360 ft) thick, upper one- third is the Tenney Canyon Tongue and is 43- 96 m (140- 315 ft) thick; entire formation is 168- 213 m (550- 700 ft) thick	High	High landslide potential; moderate rockfall potential	Springs and seeps; small to moderate yields; fresh to saline WQ	Moderate	Three- toed dinosaur tracks; snail and worm trails; fish scales; invertebrates (5)		Alcoves beneath Jn cliff	None
	Moenave Fm. Springdale mbr (Jms)	Thin, discontinuous lenses of intraformational conglomerate, with mudstone and siltstone rip- up clasts; forms the first significant cliff below the Navajo Sandstone; 27- 46 m (90- 150 ft) thick	High	High landslide potential; high rockfall potential	Limited aquifer potential; small to moderate yields; fresh to saline WQ	Low to moderate	Dinosaur tracks; poorly preserved, petrified and carbonized plants (2)		Tool source material	None
	Moenave Fm. Whitmore Point mbr (Jmw)	Sandstone, siltstone, and reddish- purple to greenish- gray mudstone and claystone and thin dolomitic limestone beds; limestones are bioturbated and contain small, moderate- reddish- brown chert nodules and blebs, algal structures, and fossil fish scales and bones of <i>Semionotus kanabensis</i> ; slope- former; 18- 24 m (60- 80 ft) thick	High	High landslide potential; moderate rockfall potential	Limited aquifer potential; small yields; poor WQ	Moderate	Dinosaur tracks, fish scales and bones ( <i>Semionotus kanabensis</i> ) (3)			None

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Lower Jurassic	Moenave Fm. Dinosaur Canyon Sandstone mbr (Jmd)	Reddish-brown, thin-bedded, very fine- to fine-grained sandstone and silty sandstone; ripple marks and low-angle cross-bedding; slope former; 53- 64 m (175- 210 ft) thick	High	High landslide potential; low rockfall potential; expandable or collapsing soils	Limited aquifer potential; small yields; poor WQ	Moderate	Burrows, tracks (2)			None
Regional Unconformity										
Upper Triassic	Chinle Fm. Petrified Forest mbr (TRcp)	Variegated gray, purple, and white shale with several layers of light-colored sandstone and limestone; abundant bentonite produces badlands topography of bare clay hills with “popcorn” weathering; paleosols are common; 137- 152 m (450- 500 ft) thick	High	Bentonite causes very high landslide potential; numerous building foundation problems with expandable or collapsing soils	Not an aquifer; fresh to saline WQ	High	Bone & teeth from fish, <i>Metoposaurus</i> sp., phytosaurs, ornithischian and aetosaurs, coprolites, petrified wood: <i>Araucarioxylon</i> sp., <i>Woodworthia</i> sp., plants, and invertebrate burrows (5)	Lead, zinc, silver, gold, manganese, uranium, bentonite, petrified wood	Tool material	None
	Chinle Fm. Shinarump mbr (TRcs)	Sandstone, pebbly sandstone, pebbly conglomerate; forms prominent east-dipping cuesta in Kolob Canyons area; 18- 41 m (60- 135 ft) thick	Low to moderate	Low landslide potential; very high cliff-forming and rockfall potential	Limited aquifer potential; small to moderate yields; fresh to saline WQ	Moderate to high	Wood	Lead, zinc, silver, gold, manganese, uranium, oil	Rock art, tool material	None
Regional Unconformity										
Lower Triassic	Moenkopi Fm. Upper Red mbr (Trmu)	Reddish-brown siltstone and shale; ripple marks; mudcracks, thin laminated bedding; regressive member; 84 m (275 ft) thick	High	High landslide potential; moderate rockfall potential	Limited aquifer potential; small yields; poor WQ	Moderate to high	Vertebrate tracks (2)		Alcoves beneath TRcs cliffs	None
	Moenkopi Fm. Shnabkaib mbr. (TRms)	Siltstone and shale interbedded with abundant gypsum; thickens westward; transgressive member; 91 m (300 ft) thick	High	High landslide potential; moderate rockfall potential; expandable or collapsing soils	Limited aquifer potential; small yields; poor WQ	Gypsum	Marine invertebrates (2)	Gypsum	Pigment	None
	Moenkopi Fm. Middle Red mbr (TRmm)	Reddish-brown siltstone and shale; ripple marks; mudcracks, thin laminated bedding; regressive member; 61 m (200 ft) thick	High	High landslide potential; moderate rockfall potential	Limited aquifer potential; small yields; poor WQ	Gypsum	Wood and bone? (2)			None
	Moenkopi Fm. Virgin Limestone mbr (TRmv)	Fossiliferous limestone with interbedded mudstone; thickens westward; transgressive member; 30 m (100 ft) thick	Low to moderate	Low landslide potential; moderate rockfall potential	Limited aquifer potential; small to moderate yields; poor WQ	Moderate to high	Marine invertebrates: bivalves, gastropods, ammonites ( <i>Meekoceras</i> sp.), asteroid starfish (2)			None
	Moenkopi Fm. Lower Red mbr (TRml)	Reddish-brown siltstone and shale; ripple marks; mudcracks, thin laminated bedding; regressive member; 49 m (160 ft) thick	High	High landslide potential; low rockfall potential	Limited aquifer potential; small yields; poor WQ	Moderate to high	Vertebrate tracks, wood and bone (2)			None
	Moenkopi Fm. Timpowep mbr (TRmt)	Brecciated (fragmented) limestone (result of cave collapse); thickens westward; transgressive member; 9- 24 m (30- 80 ft) thick	Low to moderate	Low landslide potential; moderate rockfall potential	Local aquifer; small to moderate yields; poor WQ	Oil, sulfates	Marine invertebrates (2)	Oil		None
	Moenkopi Fm. Rock Canyon Conglomerate mbr (TRmr)	Two main rock types: 1) rounded pebble and cobble conglomerate found in paleovalleys, 2) widespread, but thin, regolithic breccia; clasts are well-cemented, angular, pebble- to cobble-size chert and limestone from Harrisburg mbr of Kaibab Limestone; fill paleochannels up to several tens of feet deep; poorly developed in ZION; 0- 15 m (0- 50 ft) thick	High	Low landslide potential; moderate rockfall potential	Limited aquifer potential; small to moderate yields; poor WQ	Oil, sulfates	Wood and bone?		Tool material	None
Regional Unconformity										
Permian	Kaibab Limestone Harrisburg mbr (Pkh)	Argillaceous limestone and gypsum; exposed in ZION in two short segments of the Hurricane Cliffs; upper contact is an erosional unconformity that spans 10 to 20 million years; 46- 61 m (150- 200 ft) thick	Low	Highly faulted along Hurricane fault zone; rockfall potential	Limited	Few well or spring data; oil, sulfates potential contamination	Marine invertebrates (2)	Copper, oil, uranium prospects south of ZION		Part of the last major Permian transgression in SW Utah
	Kaibab Limestone Fossil Mountain mbr (Pkf)	Fossiliferous limestone or dolomite; exposed in ZION in two short segments of the Hurricane Cliffs; 73 m (240 ft) thick	Low	Highly faulted along Hurricane fault zone; rockfall potential; karst hazard	Karst aquifer? Moderate to high yields; poor WQ?	Few well or spring data; oil, sulfates potential contamination	Marine invertebrates (2)	Copper, oil, limestone, uranium south of ZION		Part of the last major Permian transgression in SW Utah

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Permian	Toroweap Fm. Woods Ranch mbr (Pt <sub>w</sub> )	Thick evaporates, red and white quartz arenites, thinly bedded carbonate units; collapse structures; exposed in ZION in two short segments of the Hurricane Cliffs; 46- 61 m (150- 200 ft) thick	Low to moderate	Highly faulted along Hurricane fault zone; rockfall potential	No spring or well data	No spring or well data	None			None
	Toroweap Fm. Brady Canyon mbr (Pt <sub>b</sub> )	Highly fossiliferous limestone with chert nodules, aphanitic lime mudstone, dolomite, and quartzose dolomite; exposed in ZION in two short segments of the Hurricane Cliffs; 61 m (200 ft) thick	Low	Highly faulted along Hurricane fault zone; rockfall potential	No spring or well data	No spring or well data	Brachiopods, bryozoans, crinoids, corals, foraminifera, stromatolites			None